Remarks / Arguments:

The Examiner's Office Action mailed May 12, 2005 has been carefully reviewed. Reconsideration of this application, in view of the above amendments and the following remarks is respectfully requested.

Claims 1 – 10 and 12 have been amended to more particularly and clearly define the applicant's invention and, as such, claims 1 – 12 remain in this application.

In the specification, paragraphs [007], [008], [0011] and [0019] have been amended and new paragraphs [0017.1], [0017.2] and [0019.1] have been added. It is respectfully submitted that no new matter has been added.

Paragraph [007] has been amended to delete the phrase "scalloped or" and to add the phrase - - arcuate or --, to conform to the configuration of the inner face of the split ring casting halves as shown at Figure 3.

Paragraph [008] has been amended to add the punctuation mark - - . - -, to correct a typographical omission.

Paragraph [0011] has been amended to delete the phrase "their respective rates of" and to add the phrase - - of the tube shields relative to the boiler tubes - -, to conform to the statements at paragraphs [007], [008], and [0021].

New paragraphs [0017.1] and [0017.2] have been added to provide a brief description in the drawings of Figure 6 and Figure 7 which are on file.

Paragraph [0019] has been amended to add the phrase - - and to the adjacent protective tube shields 32 as indicated at weld area 56 - -, to conform to Figures 5, 6 and 7.

Paragraph [0019] has also been amended to delete the word "bar" and to add the article - - the - -, to correct a typographical error and an omission.

Paragraph [0019] has been further amended to delete the phrase "and the retainer shield have" and to add the verb - - has - -, to conform to Figures 4, 5, 6 and 7, and to insert the singular form of the verb *have*.

Paragraph [0019] has been still further amended to delete the reference numeral "56" and to add the reference numeral - - 58 - -, to distinguish between the area of weld which connects the split ring casting halves 38 to the tube shield 32, and the area of weld which connects the retainer shield 42 to the tube shield 32.

Paragraph [0019.1] has been added to provide a detailed description in the drawings of Figure 6 and Figure 7 which are on file.

In the drawings, Figures 2–7 have been amended as follows:

Figure 2 has been amended by deleting the lead line for reference numeral 28 and replacing it with a new lead line, which correctly identifies the recess 28 formed between the spaced apart tube shields 24 and the outer surface of boiler tube 10.

Figure 3 has been amended by changing the reference numeral 38 to read - - 56 - -, which correctly identifies the area of the weld connecting the retainer shield 42 to the tube shield 32.

Figure 3 has also been amended by the addition of reference numeral 58 and associated lead line to identify the area of the weld connecting the lip member 52 of each of the two halves 38 to the tube shield 32.

Figure 4 has been amended by deleting the lead line for reference numeral 52 and replacing it with a new lead line, which correctly identifies the location of the back of the lip member 52

Figure 4 has also been amended by deleting the lead line for reference numeral 54 and replacing it with a new lead line, which correctly identifies the location of the back of the lip member 54.

Figure 4 has been further amended by changing the reference numeral 56 to read - - 58 - -, which correctly identifies the area of the weld connecting the lip member 54 of each of the two halves 38 to the tube shield 32.

Figure 5 has been amended by deleting the lead line for reference numeral 30 and replacing it with a new lead line, which correctly identifies the boiler tube 30.

Figure 5 has also been amended by deleting the lead line for reference numeral 54 and replacing it with a new lead line, which correctly identifies the lip member 54.

Figure 5 has been further amended by deleting the lead line for reference numeral 40 and replacing it with a new lead line, which correctly identifies the gap 40.

Figure 6 has been amended by the addition of the previously omitted reference numeral 38 and associated lead line to identify the half of the split ring casting 36.

Figure 6 has also been amended by the addition of the previously omitted reference numeral 44 and associated lead line to identify the area of the weld connecting the retainer shield 42 to the half 38 of the split ring casting 36.

Figure 6 has been further amended by adding the previously omitted lead line for reference numeral 50.

Figure 7 has been amended by the addition of the previously omitted reference numeral 30 and associated lead line to identify the boiler tube 30.

Figure 7 has also been amended by the addition of the previously omitted reference numeral 34 and associated lead line to identify the recess formed between the spaced apart tube shields 32 and the boiler tube 30.

Figure 7 has been further amended by the addition of the previously omitted reference numeral 50 and associated lead line to identify the tongue member of the split ring casting half 38.

The drawings were objected to under 37 CFR 1.83(a). The objection states that the drawings must show every feature of the invention specified in the claims and that, therefore, "the scalloped inner face" must be shown or the feature(s) canceled from the claim(s). The objection also stated that no new matter should be entered.

The adjective "scalloped" has been deleted from the specification and the claims. The inner face of each of the two halves of the split ring casting has been appropriately described at amended paragraphs [007] and [0019] of the specification and at amended claims 1 and 2, as having "arcuate" grooves. It is respectfully submitted that the specification and claims as presently amended are supported by the drawings which are on file and, in particular, that the arcuately grooved inner face of each of the two halves (38) of the split ring casting (36) is clearly shown at Figure 3 of the drawings on file.

We turn now to a discussion of the factors which created a need for Applicant's invention, and to the remedy provided by his invention.

As is well known in the industry, the combustion of coal and other fossil fuels during the operation of boilers for the generation of steam in utility and industrial power plants produces deposits such as soot, ash and slag that accumulate on the fireside tubular heat exchange surfaces. The accumulation of such deposits will dramatically decrease the efficiency of the boilers by greatly reducing the amount of heat transferred from the combustion gases to the fluid flowing through the tubular heat exchange surfaces. In order to maintain peak efficiency, it is necessary to regularly clean these deposits so as to

eliminate their insulating effect, and thus insure maximum heat conduction between the combustion gases and the tubular heat exchange surfaces.

The cleaning of highly heated surfaces, such as the tubular heat exchange surfaces found in the furnace and convection pass of boilers has been commonly performed by devices known in the industry as sootblowers. Typically, these sootblowers are permanently installed between tube banks to permit regular cleaning of deposits of particulate matter on the fireside of the heat exchange surfaces. Accordingly, in large utility power plant boilers it is not uncommon to have fifty or more sootblowers in conjunction with each boiler. These sootblowers provide regular cleaning of the tubular heat exchange surfaces through programmed cleaning cycles to remove accumulated deposits of soot, ash and slag from the fireside surfaces of the heat exchanger tubes and thus maintain the efficiency of the operating boiler.

Generally, a sootblower includes a retractable elongated lance tube that is regularly advanced and withdrawn through the wall of the boiler and is simultaneously rotated to position the end of the lance tube adjacent a bank of heat exchanger tubes to be cleaned. The end of the lance tube is provided with one or more nozzles which are used to project a pressurized stream of blowing medium such as steam, air or water at high velocity against the heat exchanger tubes to dislodge and clean away the soot, ash, and slag deposits. The blowing medium produces mechanical and thermal shock which causes these adhering layers of soot, ash, and slag to fall away from the heat exchange surfaces. One major advantage of cleaning boilers with sootblowers is that the boilers do not need to be shut down in order to accomplish regular cleaning of the fireside heat exchange surfaces, because cleaning is carried out while the boiler is in operation. At the conclusion of the cleaning cycle, the lance tube is retracted and withdrawn from the boiler to avoid exposure

to the intense heat generated by the combustion of the fuel which would distort and eventually destroy the lance tube.

Experience has shown that boiler tubes whose outer surfaces are subjected to impact by the high velocity and abrasive blowing medium suffer from erosion and wear. The problem of heat exchanger surface deterioration has been particularly severe in connection with cleaning the rigidly held tube bundles such as those made up of pendant boiler tubes found in larges scale boilers. Since the pendant tubes are rigidly held, they cannot distort in response to the temperature induced shrinkage and expansion occurring during the cleaning cycle. Difficulties are also present in an effort to produce adequate cleaning performance while avoiding thermal overstressing since the heat exchanger tube surfaces to be cleaned are of varying distance from the lance tube nozzle and, therefore, a varying speed of blowing medium jet progression across the heat exchanger surface occurs. Areas of slow progression may receive excessive quantities of sootblowing medium as compared to the amount required for effective cleaning. Thus, physical deterioration of the heat exchanger surfaces may occur where the tubes are over-cleaned in this manner. Such degradation of the tubular heat exchange surfaces of a boiler can produce catastrophic failures and a significant financial loss for the boiler operator.

Accordingly, protective devices in the form of tube shields are provided to prevent direct impingement of the outer surfaces of the boiler tubes by the sootblower blowing medium while allowing the tubes to be cleaned of soot, ash, slag, and other fouling deposits. Each shield is normally comprised of an axially elongated member of arcuate cross section sized to fit over the outer surface of the boiler tube to protect the portion of the tube which is impacted by the cleaning medium.

The tube shields work well in protecting the outer surface of the boiler tubes from the high velocity and abrasive blowing medium, but a problem arises when it is used with

vertically elongated boiler tubes, such as those forming pendant heat transfer surfaces, located in the furnace and convection pass, and referred to in the industry as superheaters and reheaters whose respective inlet and outlet headers and major supports are housed in a section referred to in the industry as the penthouse, with the latter being situated above the furnace and convection pass roof line. The pendant loops of these tubular heat transfer surfaces support themselves in simple tension and are subjected to stresses due to the differences in expansion between the different loops since their average temperatures are different because the fluid flowing along the tubes from the inlet to the outlet header is being heated. Therefore, it is necessary to provide split ring castings to maintain the pendant boiler tubes in parallel alignment and spaced with respect to each other. Protective tube shields are generally located immediately above and below the split ring casting. However, a serious has been encountered due to the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures, which has resulted in gaps being formed between the tube shields and the split ring casting thereby exposing a portion of the outer surface of the boiler tubes to the abrasive impact of the high velocity sootblower cleaning medium.

Experience has shown that the gap existing between the adjacent end faces of the boiler tube shield and the split ring casting is one of the most vulnerable areas to sootblower erosion due to flow disturbances created around the split ring casting. However, efforts at structurally bringing these end faces together and eliminating any gaps therebetween have met with failure due to the difference in thermal expansion of the boiler tube shield relative to the protected boiler tube at high boiler operating temperatures.

The present invention is directed to solving the aforementioned problem by providing split ring casting halves and a retainer shield which are sized to overlap adjacent portions of the upper and lower protective shields, thereby covering any gaps that may

occur between the protective tube shields and the split ring casting resulting from the difference in the rates of thermal expansion of the boiler tubes and the tube shields at high boiler operating temperatures.

Claims 1, 2, 4–9,10, 11, and 12 were rejected under 35 U.S.C. 102(b) as being anticipated by **Harth et al (6,006,702)** which is said to disclose a rigid structure of two halves (14, 16) such that when the two halves are mated, parallel and spaced apertures are formed to hold a series of tubes (18) in an aligned and fixed relationship, the tubes are said to be fitted with shields adjacent the two halves where the two halves are sized to overlap adjacent portions of the shield [sic] (22) covering potential gaps and welded (reference is made to column 2, lines 62–65) and is said to include a retainer shield (23) which encases the two halves thereby covering any gaps and are also welded at location (26).

Claims 1–10 and 12 have been amended. These amended claims and original claim 11 are believed to patentably distinguish **Harth et al**.

Applicant respectfully submits that **Harth et al** relates in general to split ring castings, and more particularly to a retainer heat shield (23) which is preferably made of a higher temperature alloy than the material of the split ring casting (12) to remedy a problem encountered with the split ring casting which, as a result of a working environment consisting of high boiler gas temperatures, causes the joiner weld (22) that holds the halves (14,16) of split ring casting (12) together, to overheat and oxidize thereby causing a failure of the weld (22) and, as a result, the split ring casting 12. Thus, it is noted that the **Harth et al** invention is that of a retainer shield (23) to protect the weld (22) on the front of the split ring casting (12) from the heated gas flow.

It is respectfully submitted that applicant and **Harth et al** are concerned with two entirely different problems and consequently different inventions, notwithstanding the similarity between several of their structural components such as Applicant's boiler tubes (30), split ring casting (36), halves (38), retainer shield (42), and **Harth et al's** boiler tubes (18), split ring casting (12), halves (14,16), and retainer shield (23).

Notably, the **Harth et al** structure does not in any way address the problem faced by applicant, since the boiler tubes in the **Harth et al** patent are not equipped with tube shields. The only form of shield disclosed in **Harth et al** is a retainer shield (23) whose sole function is to protect the split ring casting weld (22). As hereinbefore mentioned the **Harth et al** retainer shield (23) is similar to applicant's retainer (42), however, the similarity of these two components has absolutely nothing to do with the problem addressed by applicant's invention which is the protection of the boiler tube itself, rather than the split ring casting, from the abrasive impact of the high velocity sootblower blowing medium, by covering any gaps occurring between the sootblower shields and the split ring casting as a result of the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures.

Claims 3 and 9 were rejected under 35 U.S.C. 103(a) as being unpatentable over **Harth et al (6,006,702)** in view of **Jacksits (5,404,941)**. **Harth et al** is said to disclose applicant's primary inventive concept as stated above but does not particularly teach a connecting means between some to the spaced apertures of the two halves of the rigid structure. It is further said that **Jacksits**, however, teaches that it is known in the art to use connection means (17) (reference is made to Figures 1–3) for clamping a rigid structure spacer ring in relation to the tubes. It is also said that it would have been obvious at the time the invention to a person having ordinary skill in the art to have incorporated the

connecting means of **Jacksits** into the rigid structure of **Harth et al** for the purpose of clamping together both halves of the split ring casting for supporting tubes in a boiler.

As hereinabove noted, **Harth et al** is not concerned with the problem facing the Applicant and, therefore, does not disclose the structure required to overcome such problem. **Jacksits** is seen as being equally lacking in the showing of structure for overcoming the problem faced by applicant. As hereinbefore discussed, the boiler tubes in **Harth et al** are not fitted with protective tube shields, and neither are those addressed in **Jacksits**. Therefore, combining the **Jacksits** and **Harth et al** disclosures still falls short of the teaching of a structure for protecting the boiler tubes from the abrasive impact of the high velocity sootblower medium in the gaps occurring between the tube shields and the split ring casting due to the difference in thermal expansion of the tube shields relative to the boiler tubes at high boiler operating temperatures. **Jacksits** is concerned with a split ring casting construction wherein one half of the casting is formed with extended portions and the other half with projections, and wherein the extended portions overlap the projections and are welded thereto to fixedly join the two halves of the split ring casting.

Accordingly, Applicant respectfully submits that one of ordinary skill in the art would not be motivated to look to **Harth et al** and/or **Jacksits** for a teaching on preventing the erosion of boiler tubes between protective tube shields and a split ring casting since tube shields are not considered or addressed by either of these two references.

Pratt et al (3,809,018), **Green (5,724,923)**, and **Schwoerer et al (4,285,396)** were made of record, but not relied upon.

Pratt et al is directed at providing a furnace support arrangement in vapor generators having a furnace section which is divided in upper and lower portions, with the upper portion being top supported. In this type of vapor generator, alternate tubes of the upper and lower portions are coextensive and interlaced with each other. The support

arrangement disclosed in **Pratt et al** is transversely positioned with respect to the tube axes and secured to the upper and lower portions of the furnace. It is said that in this manner it is possible to avoid using welded connections contiguous to the tubes, thereby making it possible to more easily fabricate a welded seal arrangement and minimize the thermal stresses at the seal location.

Green is directed at providing a refractory shields for protecting a superheater tube from the abrasion, corrosion, and excessive operating temperatures of a waste gas stream. The refractory shield is comprised of first and second partial-tubes of C-shaped configuration and whose ends are opposably engaged so as to prevent radial movement of the first partial tube relative to the second partial tube.

Schwoerer et al is directed at a system for supporting a bundle of tubes against lateral movement in a heat generator of the kind used in nuclear power and known as pressurized-water type steam generators. The tube bundle is many feet high and, consequently, the tubes must be supported laterally at several elevations along their length in order to limit flow-induced vibrations during normal operation and to limit stresses in the tubes during abnormal conditions. The **Schwoerer et al** tube bundle support system is comprised of a number of spring collars surrounding each tube and spaced along the length thereof to permit lateral movement of the tubes but prevent any relative movement between the tube and its associated spring collar. Any lateral movement is between adjacent spring collars. Therefore, **Schwoerer et al** says that fretting and corrosion between the tubes and their spring collars is essentially eliminated by its support arrangement.

Green is directed at the structural make-up of a refractory tube shield, and **Pratt et al** and **Schwoever et al** are concerned with the structural support of tubes. None of these references taken alone or in combination are seen as addressing the problem faced by the

applicant which is the result of the difference in thermal expansion of the protective tube shields relative to the protected tubes at higher boiler operating temperatures, creating gaps between the tube shields and the split ring casting thereby exposing a portion of the outer surface of the boiler tubes to the abrasive impact of the high velocity sootblower cleaning medium. Applicant's invention provides a novel structure for covering such gaps and thus protecting the outer surface of the boiler tubes.

Accordingly, Applicant respectfully submits that claims 1 – 12, as presented, are patentably distinct and nonobvious over the prior art references, taken separately or in combination.

Applicant has endeavored to make the foregoing response sufficiently complete to permit prompt, favorable action on the subject patent application. In the event that the Examiner believes, after consideration of this response, that the prosecution of the subject patent application would be expedited by an interview with an authorized representative of the Applicant, the Examiner is invited to contact the undersigned at (330) 860-6605.

Respectfully submitted,

X Eric Marich

Eric Marich
Attorney for Applicant
Reg. No. 32,265

Date: X 12 August 2005

The Babcock & Wilcox Company
Patent Department
P.O. Box 351
20 South Van Buren Avenue
Barberton, Ohio 44203

Amendments to the Drawings:

The attached sheets of drawings include the following changes to Figures 2–7. These sheets, which include Figures 2–7, replace the original sheets including Figures 2–7.

Figure 2 (drawing sheet 1)

The lead line for reference numeral 28 has been deleted and replaced by a new lead line.

Figure 3 (drawing sheet 2)

The reference numeral 38 has been changed to read - - 56 - -.

The reference numeral 58 and associated lead line have been added.

Figure 4 (drawing sheet 2)

The lead line for reference numeral 52 has been deleted and replaced by a new lead line.

The lead line for reference numeral 54 has been deleted and replaced by a new lead line.

The reference numeral 56 has been changed to read - - 58 - -.

Figure 5 (drawing sheet 2)

The lead line for reference numeral 30 has been deleted and replaced by a new lead line.

The lead line for reference numeral 54 has been deleted and replaced by a new lead line.

The lead line for reference numeral 40 has been deleted and replaced by a new lead line.

Figure 6 (drawing sheet 3)

The previously omitted reference numeral 38 and associated lead line have been added.

The previously omitted reference numeral 44 and associated lead line have been added.

The previously omitted lead line for reference numeral 50 has been added.

Figure 7 (drawing sheet 3)

The previously omitted reference numeral 30 and associated lead line have been added.

The previously omitted reference numeral 34 and associated lead line have been added.

The previously omitted reference numeral 50 and associated lead line have been added.

Attachment: Replacement Sheets

Annotated Sheets Showing the Changes

Annotated Sheet Showing the Changes

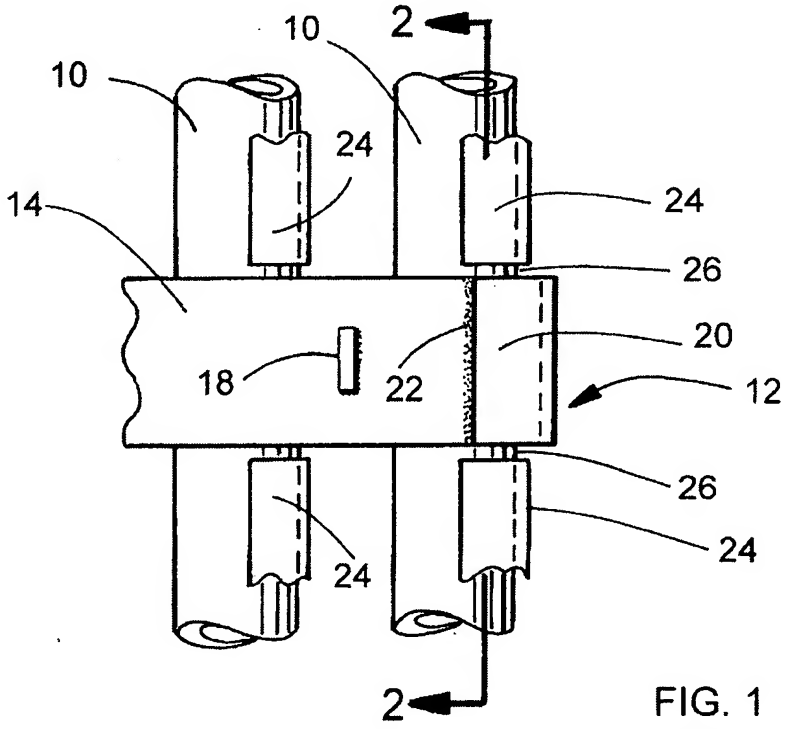

FIG. 1
PRIOR ART

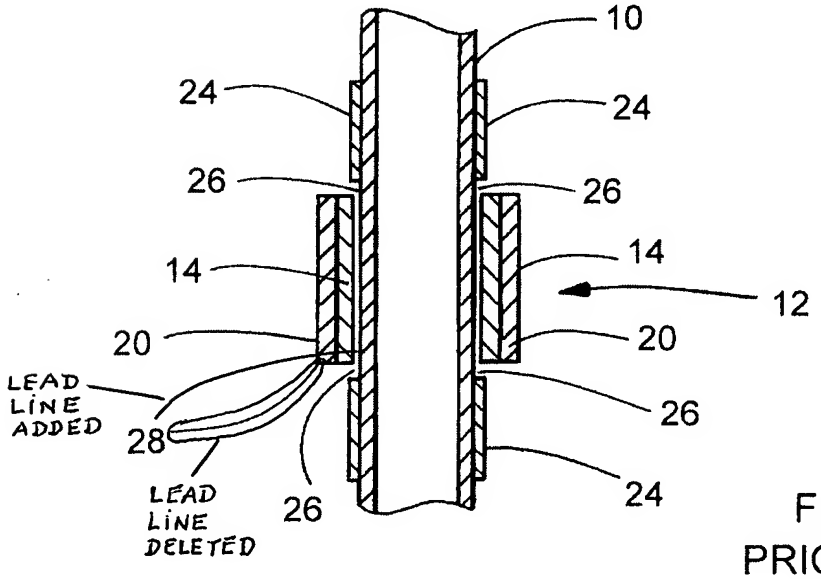

FIG. 2
PRIOR ART

Annotated Sheet Showing the Changes

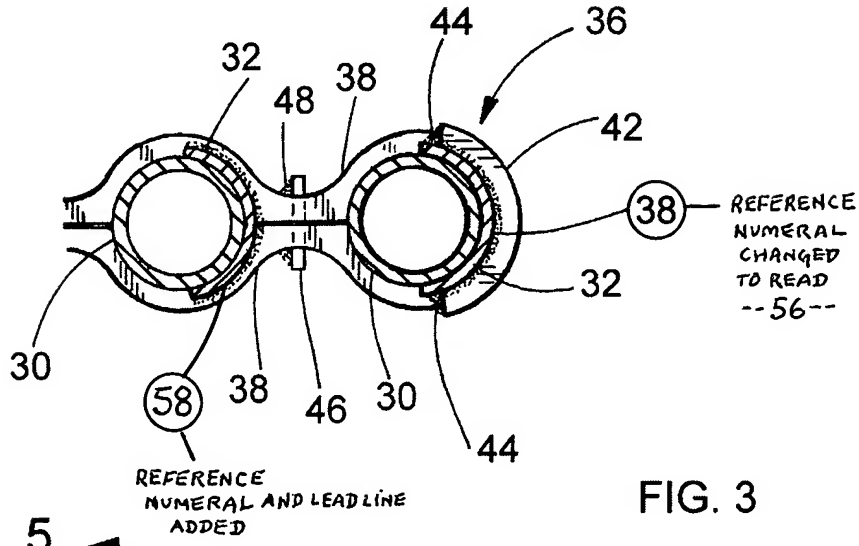

FIG. 3

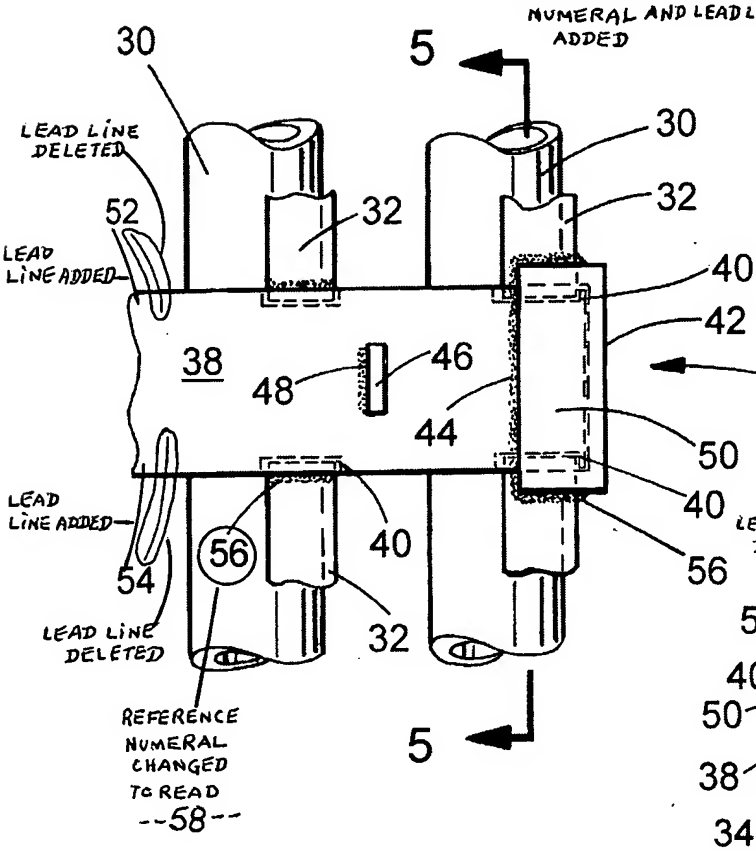

FIG. 4

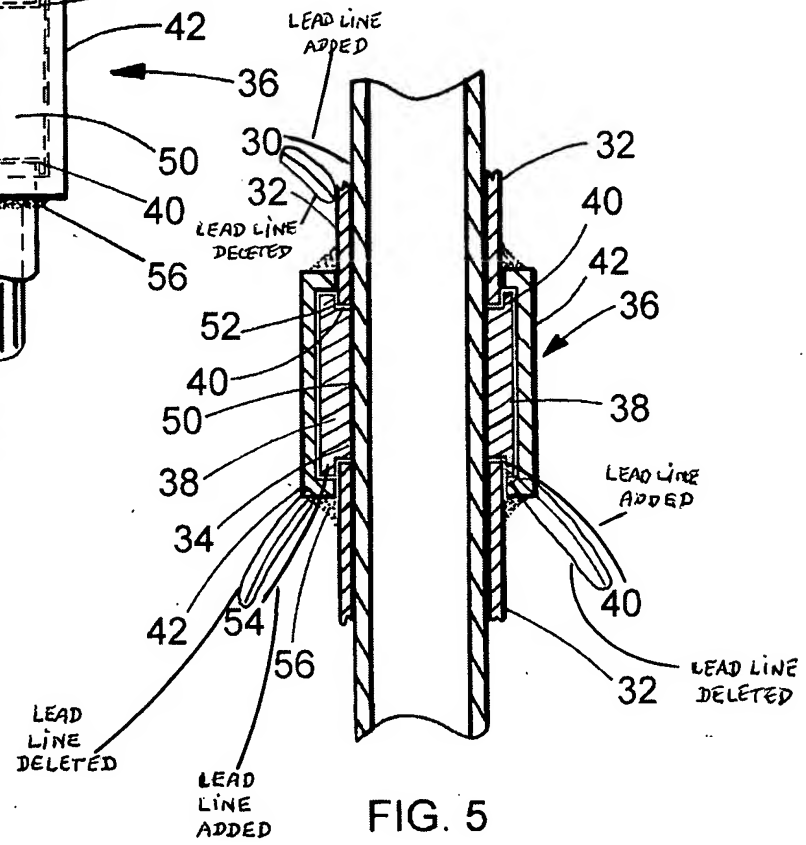

FIG. 5

Annotated Sheet Showing the Changes

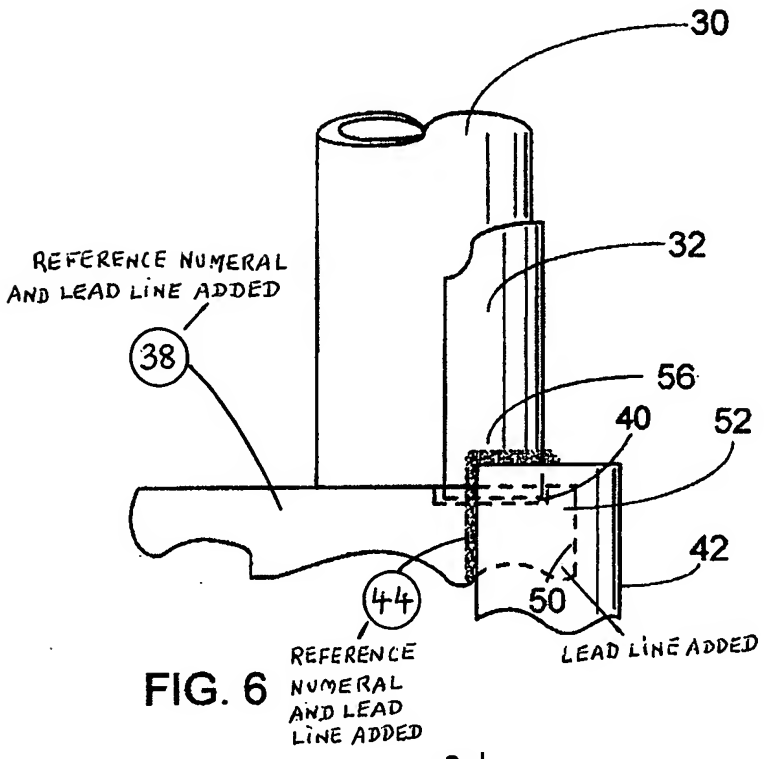

FIG. 6

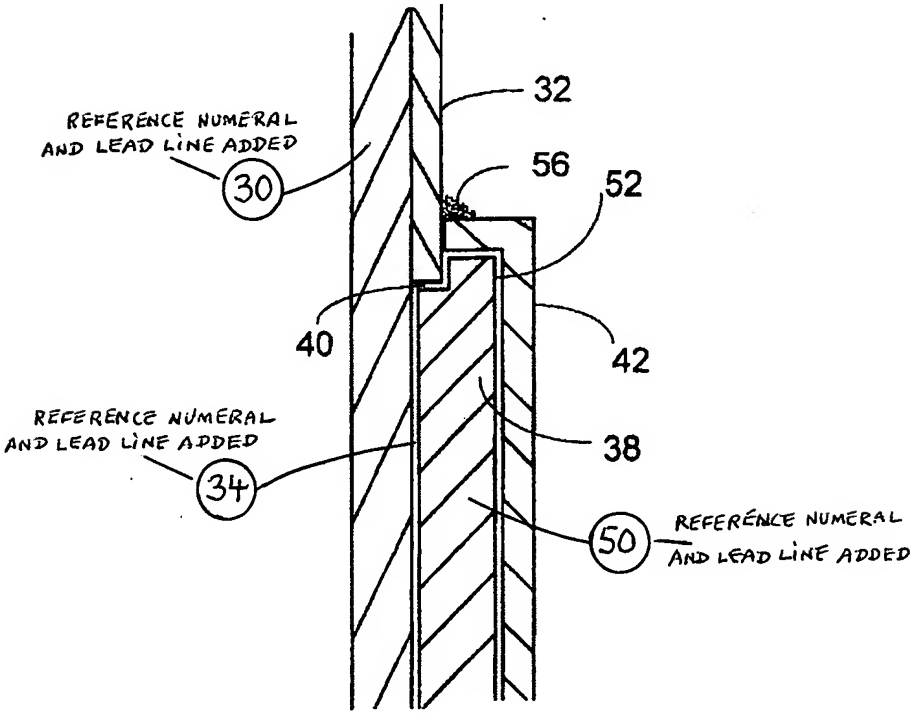

FIG. 7